

Beryllium Window Pressure Analysis

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Problem Summary

An FEA analysis of the differential pressure and resulting stresses on a beryllium window was done. The window is made of 0.015 inch thick beryllium and is held in place by a copper alloy clamp. The pressure was applied on both the convex and concave side of the window. The pressures that result in a Factor of Safety of 1 in yield and a Factor of Safety of 2 in ultimate were found.

Beryllium Material Properties

Property	Value	Unit
Density	.06673	lb/in ³
Young's Modulus	4.2931×10^7	psi
Poisson's Ratio	.1	psi
Bulk Modulus	1.7888×10^7	psi
Shear Modulus	1.9514×10^7	psi
Tensile Yield Strength	41046	psi
Tensile Ultimate Strength	65006	psi

Constraints and Assumptions

- Axisymmetric model used
- Beryllium window is perfectly clamped
 - Fixed supports were used on both clamps and the outer edge of the window
- Pressure distribution is uniform and normal to the surface
- Gravity is negligible
- Clamps are Copper Alloy

Mesh Statistics

- 10781 Nodes
- 2878 Elements
- Element Quality
 - Min = 0.7747
 - Max = 0.9997
 - Average = 0.9721
 - Standard Deviation = 1.8959×10^{-2}

Location	Pressure (psi)	Max Equivalent von-Mises Stress (psi)	Notes
Concave	0.76	40669	SF 1, Yield
Convex	0.76	40670	SF 1, Yield
Concave	0.6	32107	SF 2, Ultimate
Convex	0.6	32108	SF 2, Ultimate

Results

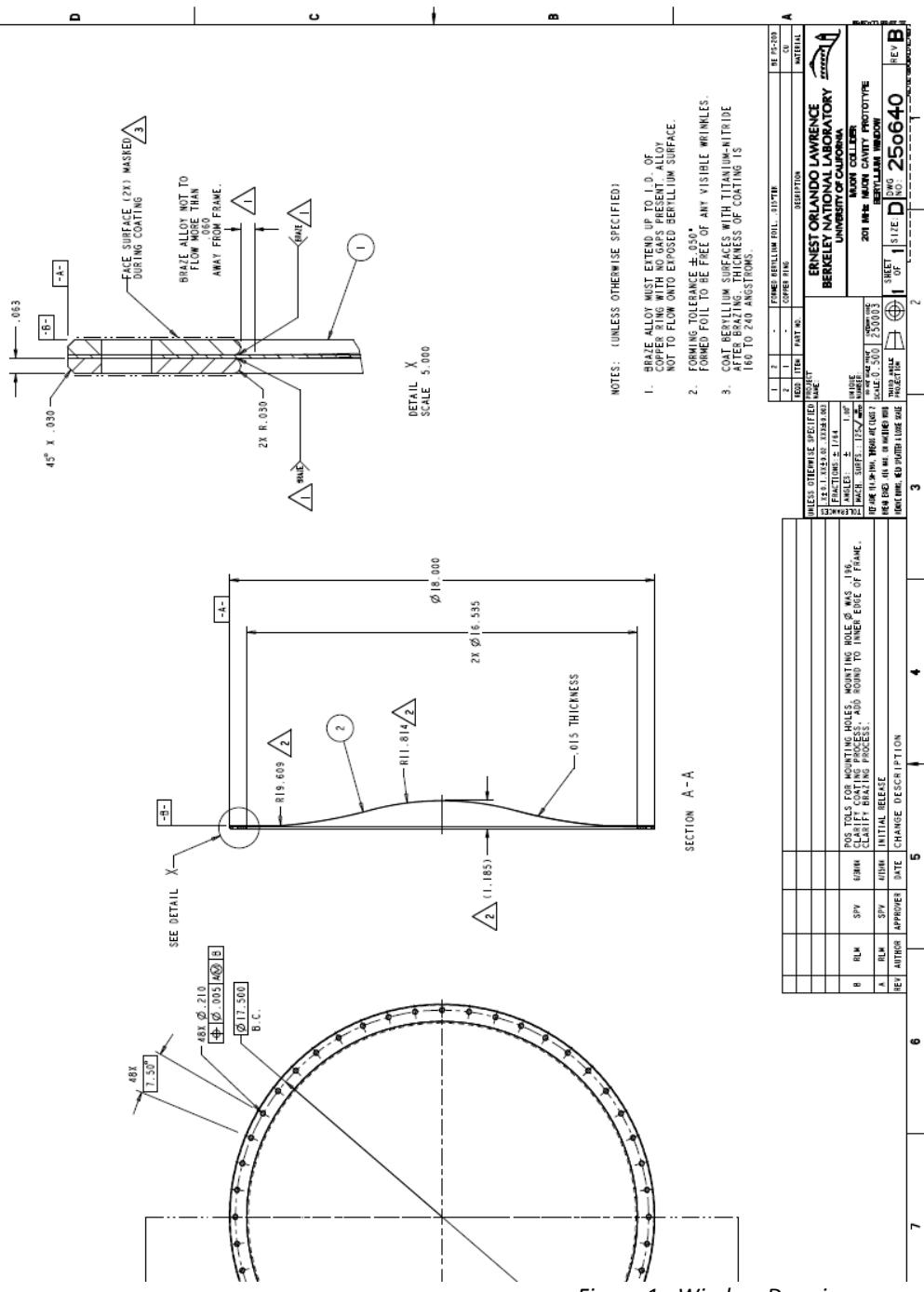


Figure 1 - Window Drawing

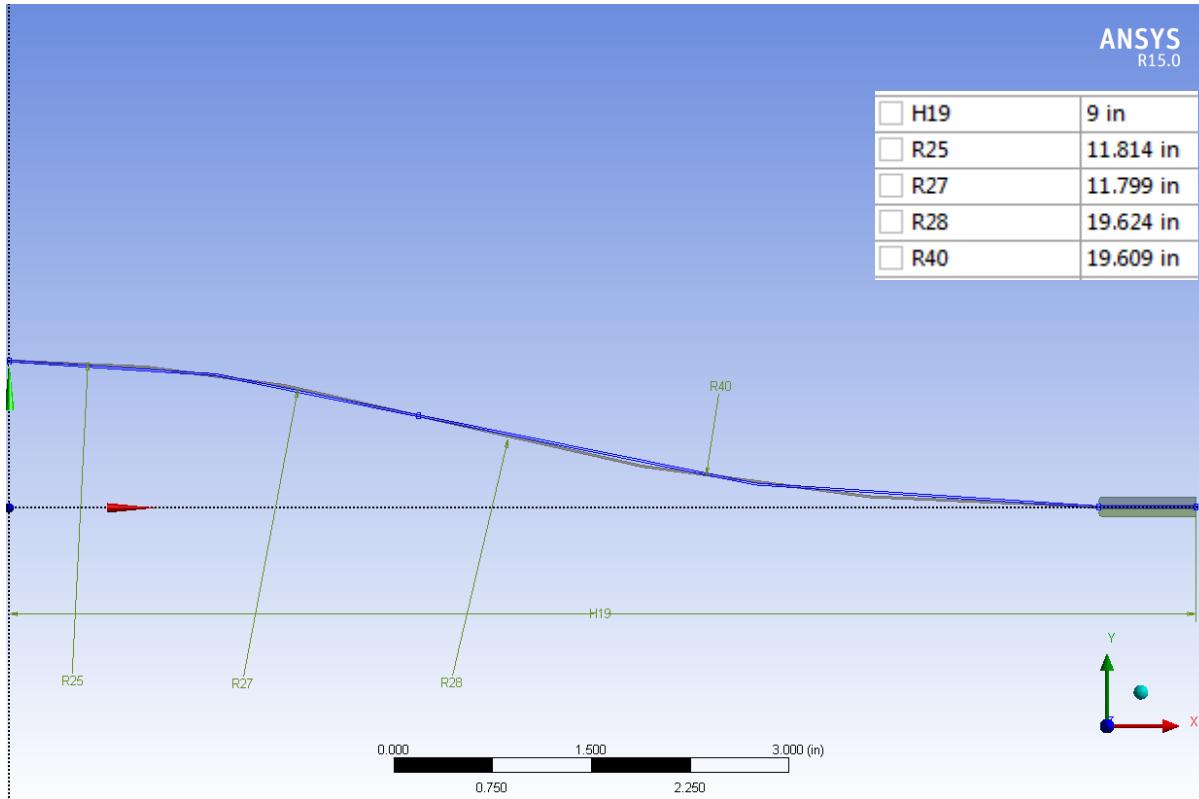


Figure 2 - Dimensions of 0.015" Thick Window

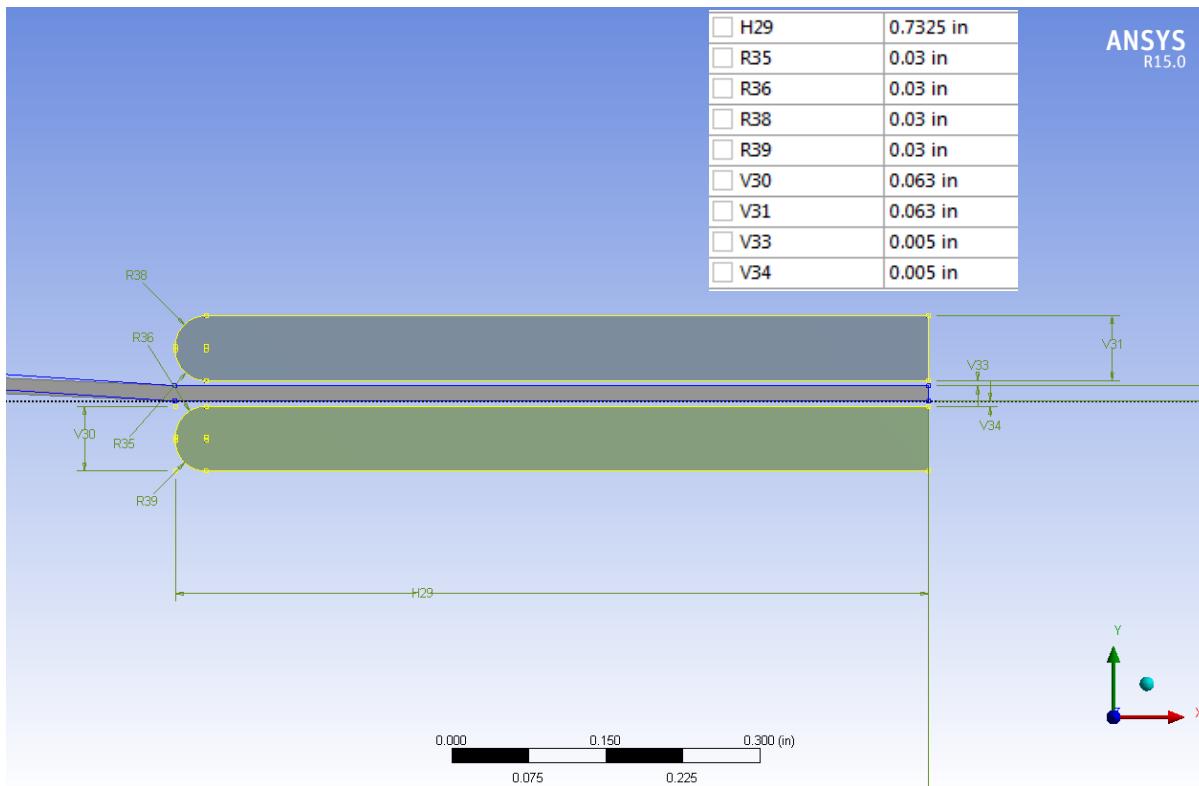


Figure 3 - Dimensions of Copper Alloy Clamp

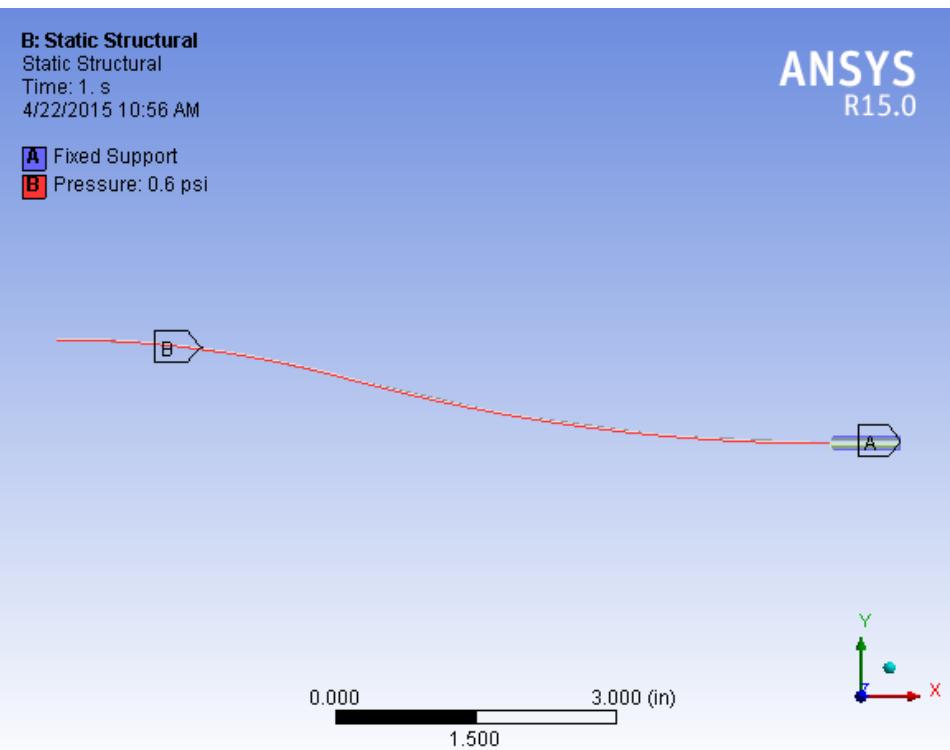


Figure 4 - Loading and Constraints

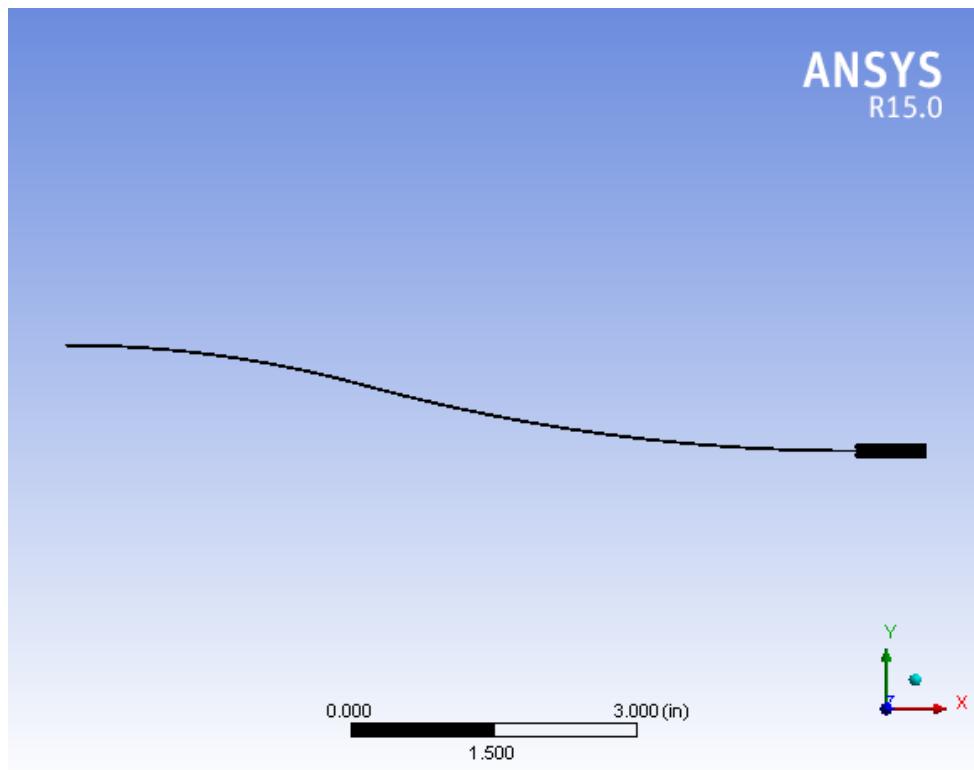


Figure 5 - Mesh

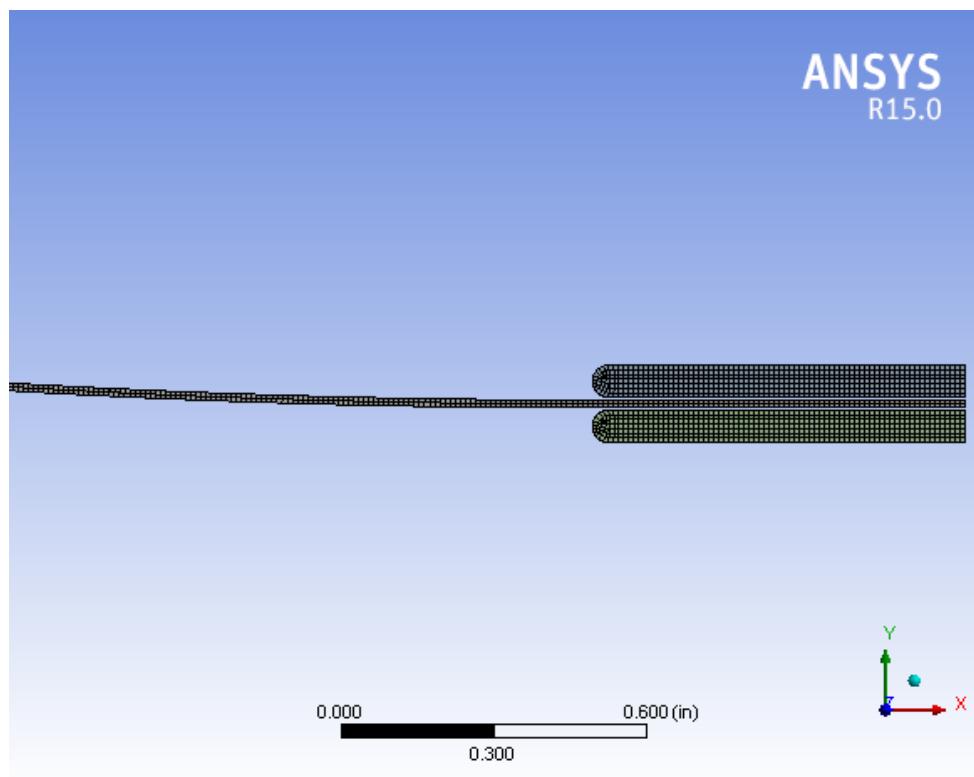


Figure 6 - Zoomed in Mesh

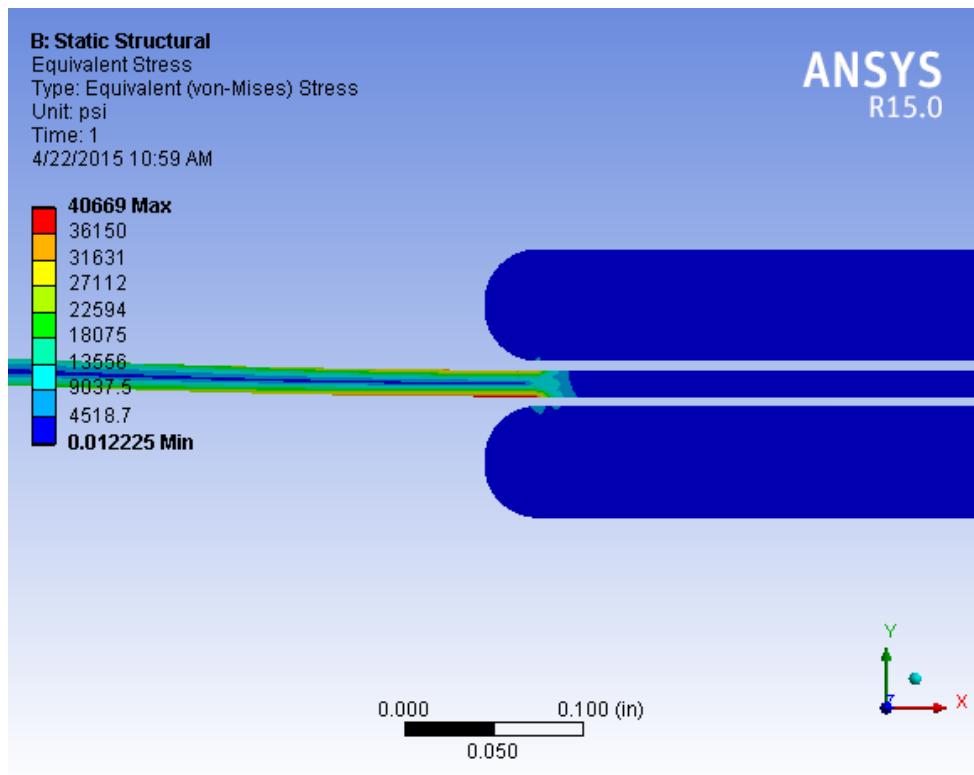


Figure 7 - 0.76 psi applied to concave side

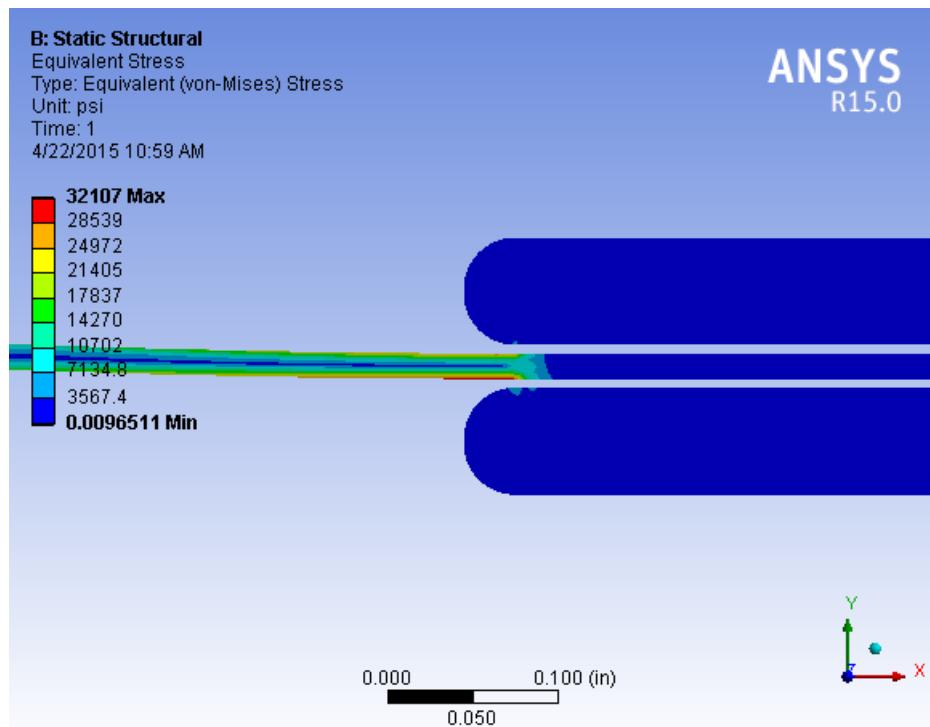


Figure 8 - 0.6 psi applied to concave side

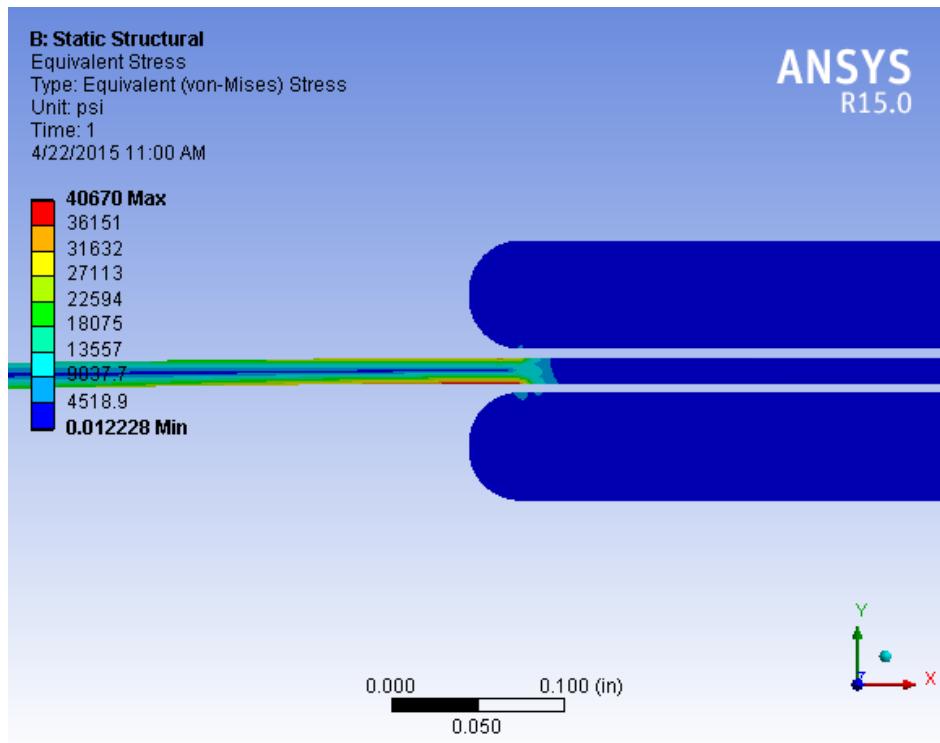


Figure 9 - 0.76 psi applied to convex side

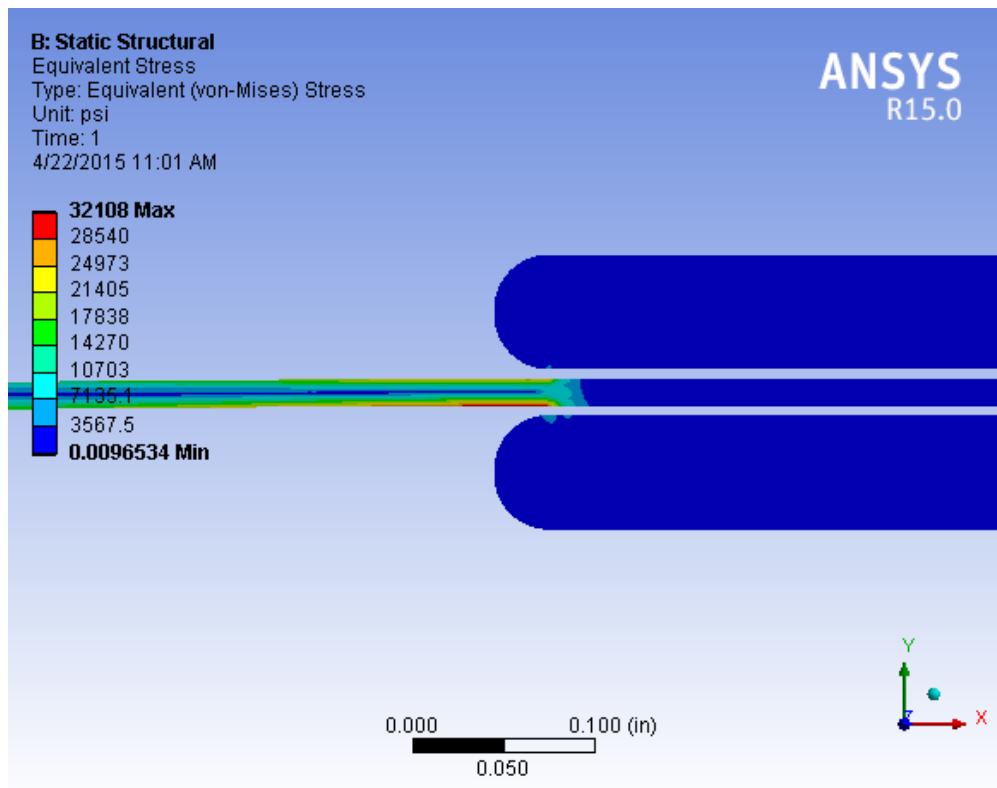


Figure 10 - 0.6 psi applied to convex side